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TECHNICAL REPORT ARBRL-TR-02266

WNDWBX: TEKTRONIX PLOTTING ON CDC

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September 1980

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
BALLISTIC RESEARCH LABORATORY
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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)* (clt)

WNDWBX is an interactive plotting program accessible through a single Fortran CALL. It uses given input data to generate curves and label axes. Titles, new axis dimensions, and curve labels can be supplied interactively. The user is not required to have plot software knowledge or experience.

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I. INTRODUCTION

Due to increasing use of computer models and data manipulation by scientists, there has arisen a need for a plotting package which can show data curves on a computer terminal CRT, yet does not require the casual user to develop his own plotting software. Such a program is available for the Tektronix CRT's on the BRL CDC system.

II. DESCRIPTION

WNDWBX is a Fortran subroutine which uses the Tektronix PLOT10[1] software to generate point-to-point plotting of data vectors. Axes are initially scaled and labeled with parameters returned from the BRL FIXSCA subroutine.[2]

The user must supply data from some generating program; then through a single Fortran calling statement he can access the plotting routines. The required call is:

```
CALL WNDWBX (X, Y, M, N, NPTS),
```

where X = horizontal axis data vector,
Y = vertical axis data vector,
M = maximum number of data points to be plotted,
N = number of curves to be shown on the plotted surface (1 to 3),
NPTS = vector of size (3) containing respective number of data points in each curve. ($M \geq$ Total of NPTS.)

The data-generating main program must define files PLB and KBI in its program statement (see test program listing in the Appendix). WNDWBX requires that the main program be supplied in relocatable form; this may be accomplished in one of two ways:

A. (1) Attach a source-code file.
(2) Compile the source code into LGO.
(3) Attach the WNDWBX procedure.
(4) Begin the WNDWBX procedure.

As an example, suppose file FORT (ID = FRED and CY = 1) contains the source code in the Appendix. Then,

---

[1] *TEKTRONIX Plotting (PLOT10) Package, BRL SPB-8-78, 14 July 1978.*

[2] *Monte W. Coleman and John V. Lanahan, "BRLESC Fortran Plotting Subroutines", ARDC Technical Report No. 6, p. 36, July 1970.*

```
Step 1:  ATTACH, FORT, ID = FRED, CY = 1.
Step 2:  FTN (I = FORT, L = 0, B = LGO).
Step 3:  ATTACH, WNDWBX.
Step 4:  BEGIN, RUN, WNDWBX, LF = LGO.
```

or,

B. (1) Attach the WNDWBX procedure.
(2) Begin the procedure and provide to it a pre-compiled and catalogued main program.

For example, suppose after Step 2 of the previous case that the user decided to catalog his compiled code into file FORT, ID = FRED, CY = 2. (The command would have been: 'CATALOG, LGO, FORT, ID = FRED, CY = 2'.) Then a 'RETURN, LGO' would free the file. Next,

```
Step 1:  ATTACH, WNDWBX.
Step 2:  BEGIN, RUN, WNDWBX, PF = FORT, ID = FRED, CY = 2.
```

Both methods use a Cyber Control Language procedure to connect I/O files, attach libraries, load and execute the program, and return local files after execution. (Method A uses a copy of LGO to generate an executable program.)

The first time WNDWBX is called, it polls the user for a data transmission rate - either 30, 120, or 960 characters/second (corresponding to 300, 1200, and 9600 baud, respectively). The internal calls to the PLOT10 setup routines assume a screen size of 1024 by 780 addressable points; buffer size is arbitrarily set to 3. These parameters are reasonable in most cases and the user cannot change them.

III. SAMPLE CASE

A simple sine, cosine, and sine + cosine data-generating program is available for test use simply by attaching the WNDWBX procedure and executing the command: 'BEGIN, TEST, WNDWBX'.

The sample case first asks for an input from the user in order to start the data generation. Then a list of options will appear as in Figure 1. If option 1 is chosen (enter the number "1" through the keyboard), an unlabeled set of curves will be shown (Figure 2).

When the curves are shown, there is no screen prompt to tell the user what to do next. Entering any number from the keyboard will cause the graph to disappear and a list of options will appear (Figure 3). Axis and curve titles may be entered through options 5, 6, 7, and 8 (Figure 4). Then option 1 will show the plot with the new titles (Figure 5).

```
CURVE GENERATING ROUTINE

OPTIONS:    0 = STOP
            1 = PLOT
            2 = CHANGE DATA

  OPTION? >1
```

Figure 1. Option Table in Test Plot Routine

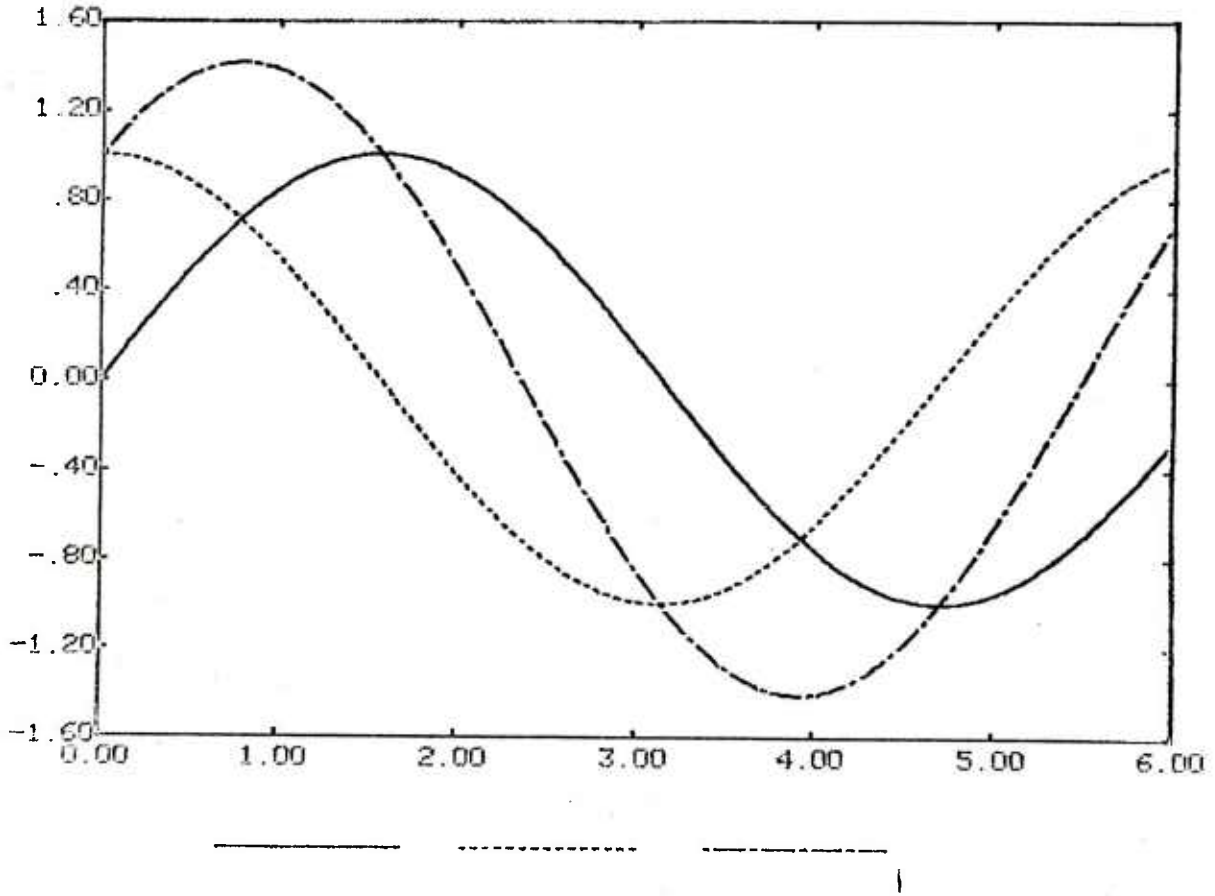

Figure 2. First Plot Using Default Values From Test Routine

```
OPTIONS:
   0 = RETURN TO CALLING PROGRAM
   1 = PLOT
                                                    MIN          MAX          DEL
   2 = CHANGE HORIZONTAL AXIS PARAMETERS            0.           6.00         1.00
   3 = CHANGE VERTICAL AXIS PARAMETERS             -1.60         1.60         .400
   4 = REVERT TO ORIGINAL AXIS PARAMETERS
   5 = CHANGE TITLE   *                                                      *
   6 = CHANGE HORIZONTAL AXIS TITLE  *                                       *
   7 = CHANGE VERTICAL AXIS TITLE    *                                       *
   8 = CHANGE CURVE TITLE(S)            1 *            *
                                        2 *            *
                                        3 *            *

  OPTION? >
```

Figure 3. Option Table for Figure 2

```
OPTIONS:
   0 = RETURN TO CALLING PROGRAM
   1 = PLOT
                                                  MIN          MAX          DEL
   2 = CHANGE HORIZONTAL AXIS PARAMETERS          0.           6.00         1.00
   3 = CHANGE VERTICAL AXIS PARAMETERS           -1.60         1.60         .400
   4 = REVERT TO ORIGINAL AXIS PARAMETERS
   5 = CHANGE TITLE    *THIS IS WHERE OVERHEAD TITLE IS PLOTTED *
   6 = CHANGE HORIZONTAL AXIS TITLE   *  HORIZONTAL TITLE  *
   7 = CHANGE VERTICAL AXIS TITLE     * VERTICAL    TITLE   *
   8 = CHANGE CURVE TITLE(S)              1 *    SINE.    *
                                          2 *  COSINE    *
                                          3 *SIN + COS    *

  OPTION? >
```

Figure 4. Option 5,6,7, and 8 Exercised From Figure 3

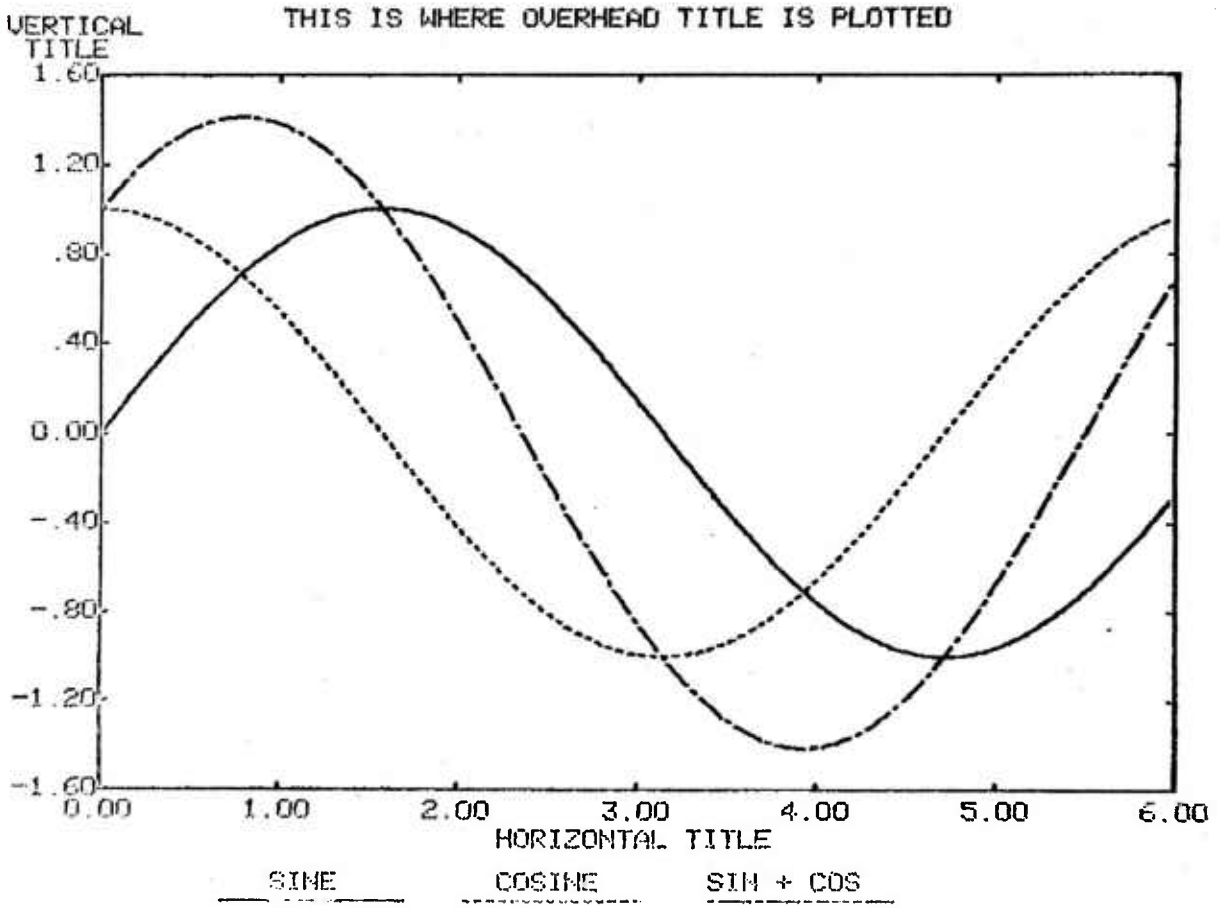

Figure 5. Test Curves with Titles

After entering another number to clear the screen, and choosing option 0 to return to the main program, the test case will allow the user to change the curves by entering different coefficients for the equations (Figure 6). The new data is plotted in Figure 7, showing the scientific notation style of axis labeling - three significant figures along the vertical axis and an exponent near the upper left hand corner. WNDWBX uses this style when the axis labels need to show more than three digits. The horizontal axis, too, has this option and the exponent is printed just below the lower left hand corner of the box.

Options 2 and 3 from the option table allow the user to choose a "window" from the original plot by setting new axis maximums and minimums. Figure 8 shows the option table and a new set of axis limits. The plot option at this time gives the graph shown in Figure 9. The intersection of the curves is now visible in much greater detail.

Option 4 returns the axis limits to show the whole curve at the time of the last WNDWBX call (Figure 10).

When using this set of plotting routines, an added feature is available to the programmer - a Fortran-callable screen erasure. A simple CALL ERS at the appropriate step in the generating routine will enable the user to clear the Tektronix screen. Comparing the interactive operation of the test plot program to its Fortran listing in the Appendix will show the value of this subroutine.

IV. SUMMARY

The WNDWBX routine is a powerful tool in modeling applications. It can plot one to three data curves without prior knowledge of the data limits. WNDWBX allows the scientist to inspect the data closely by using the "zoom" feature to select and enlarge any portion of the plotted data. The routines are available and easily used by means of a Cyber Control Language procedure which enters much of the command runstream for the user.

```
CURVE GENERATING ROUTINE

OPTIONS:    0 = STOP
            1 = PLOT
            2 = CHANGE DATA

  OPTION? >2

  CURVE 1 = C1 * SIN(X)
  CURVE 2 = C2 * COS(X)
  CURVE 3 = C3 * ( C1 * SIN(X) + C2 * COS(X) )

 NUMBER OF CURVES TO PLOT? >3

  MULTIPLIER(S)

COEFFICIENT FOR    SIN    CURVE? >1000

COEFFICIENT FOR    COS    CURVE? >2000

COEFFICIENT FOR SIN + COS CURVE? >.5
```

Figure 6. Changing Curve Parameters in Generating Routine

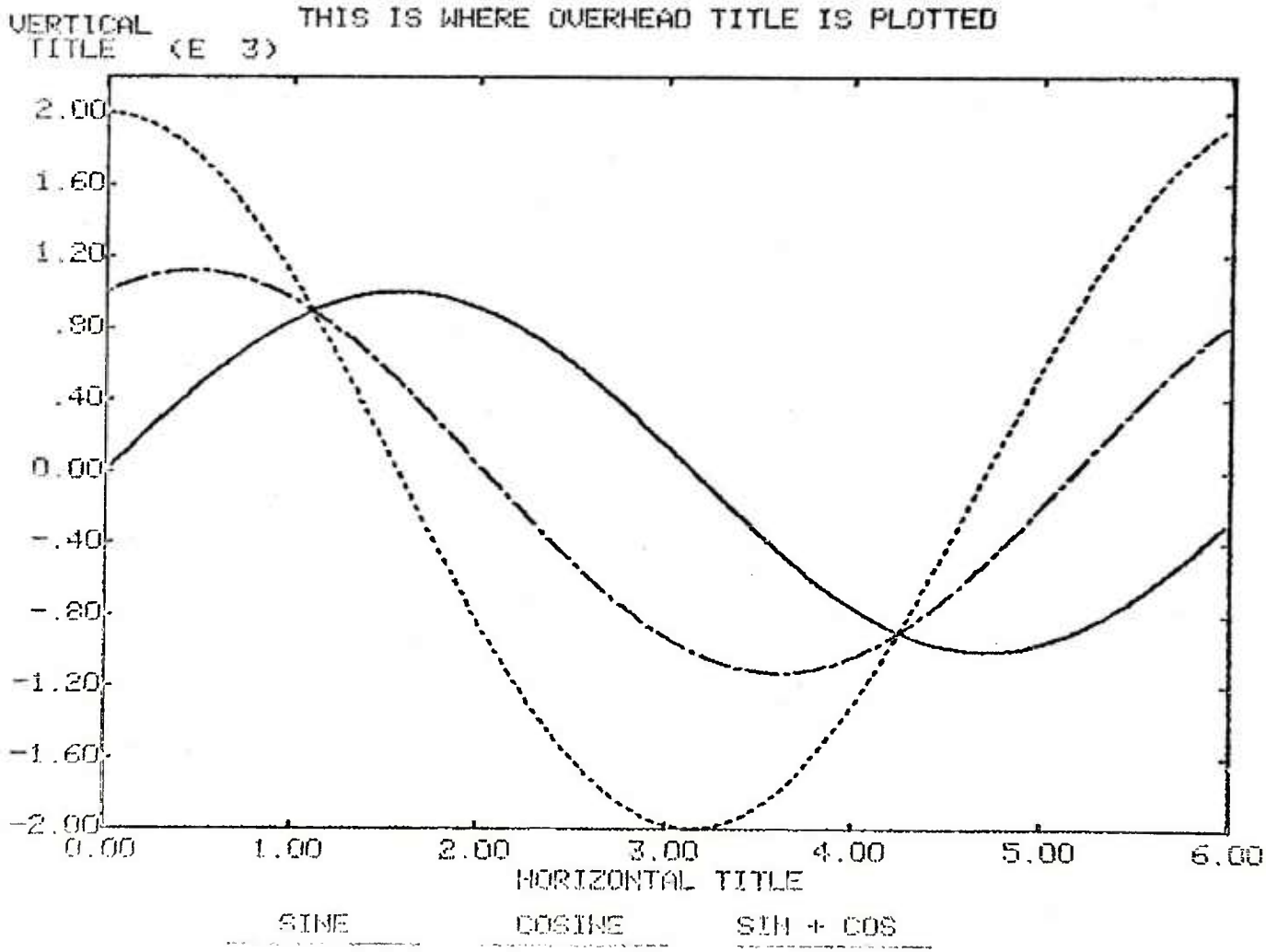

Figure 7. New Curves using Parameters from Figure 6

```
OPTIONS:
   0 = RETURN TO CALLING PROGRAM
   1 = PLOT
                                                    MIN          MAX          DEL
   2 = CHANGE HORIZONTAL AXIS PARAMETERS            1.00         1.25         .500E-01

   3 = CHANGE VERTICAL AXIS PARAMETERS              850.         950.         10.0
   4 = REVERT TO ORIGINAL AXIS PARAMETERS
   5 = CHANGE TITLE    *THIS IS WHERE OVERHEAD TITLE IS PLOTTED *
   6 = CHANGE HORIZONTAL AXIS TITLE   *  HORIZONTAL TITLE  *
   7 = CHANGE VERTICAL AXIS TITLE     * VERTICAL   TITLE   *
   8 = CHANGE CURVE TITLE(S)                1 *   SINE    *
                                            2 *  COSINE   *
                                            3 *SIN + COS  *

  OPTION? >
```

Figure 8. Horizontal and Vertical Axis Parameters Changed to Provide "Zoom" Feature

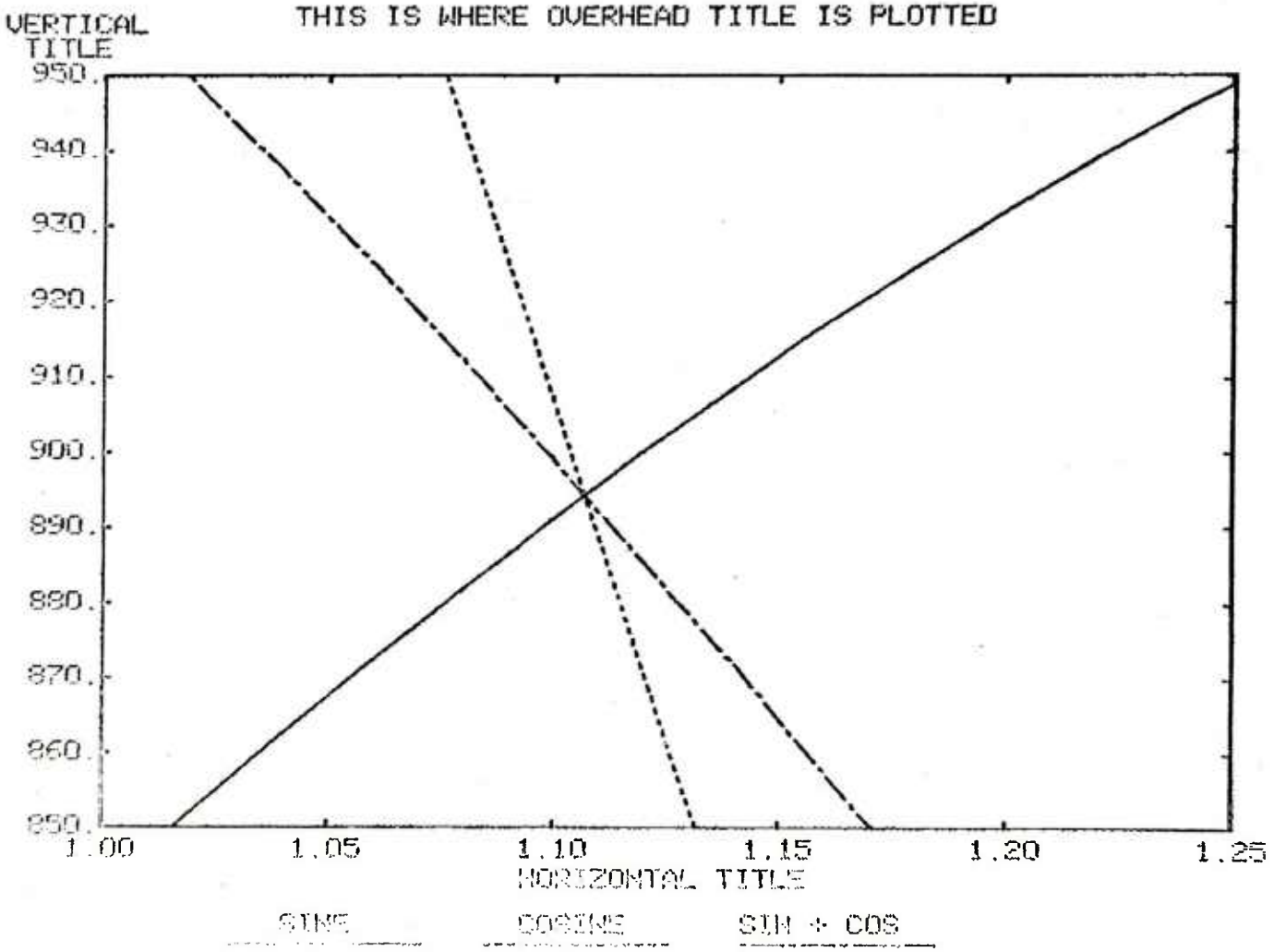

Figure 9. "Zoom" Window Using Axis Parameters from Figure 8

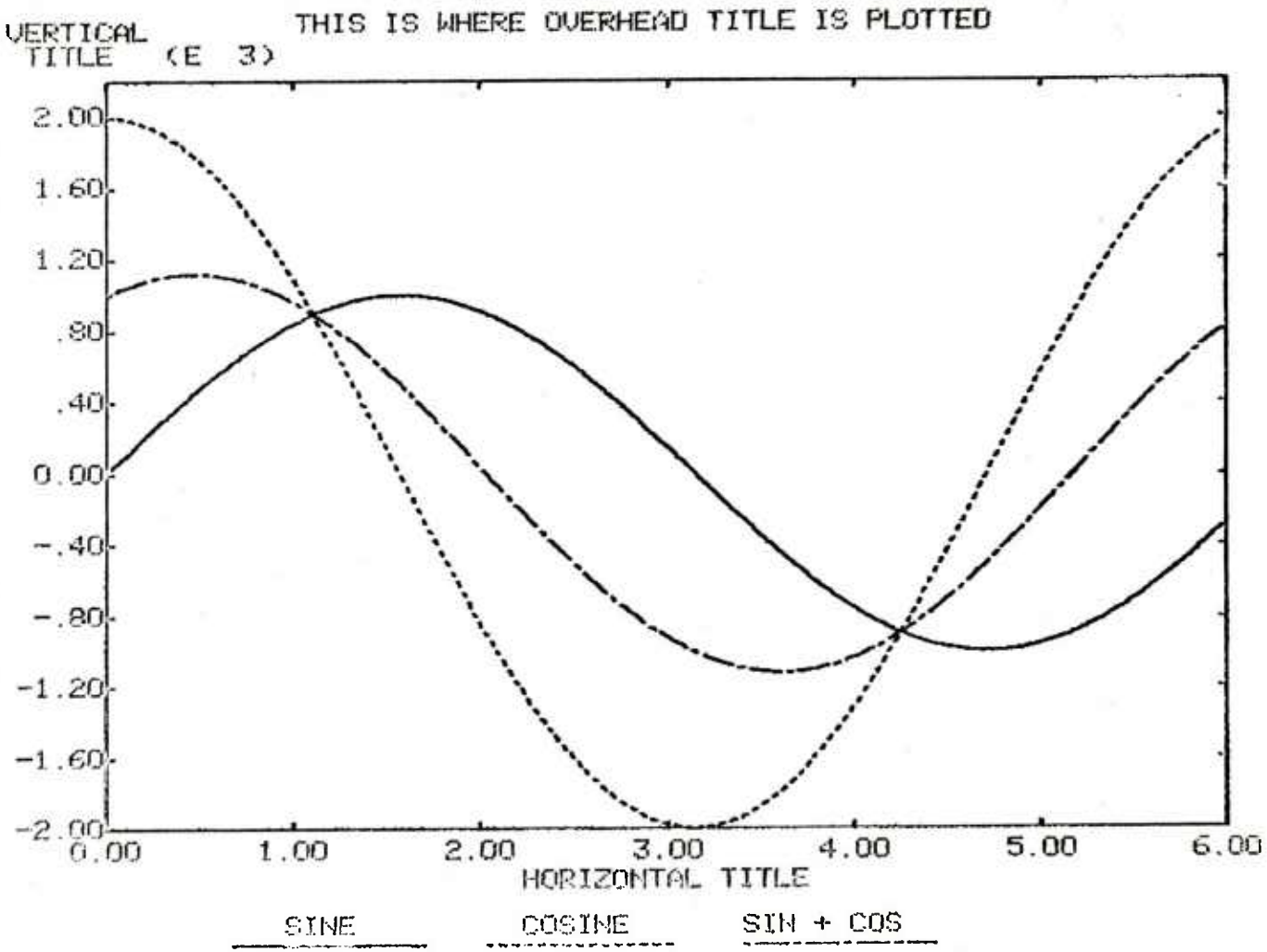

Figure 10. Option 4 Exercised - Return to Original Axis Parameters (Same as Figure 7)

APPENDIX

TEST PROGRAM LISTING

```
PROGRAM ONE        73/173  OPT=1 ROUNO=+-*/                FTN 4.8+498        05/12/80  10.01.17

1                  PROGRAM ONE(INPUT,OUTPUT,TAPE9=INPUT,PLH,KB1)                          000100
                   OIMENSION X(1000),Y(1000),NPTS(3),C1(3),S(3)                           000110
                   OATA NPTS,C1/300,300,300,3*1.0/                                        000120
                   DATA S/9H   SIN   ,9H   COS   ,9HSIN + COS/                            000130
                   CALL ERS                                                               000140
5                  PRINT *,' '                                                            000150
                   PRINT *,'    TEST PLOT PROGRAM'                                        000160
                   PRINT *,' '                                                            000170
                   PPINT *,'         ENTER NUMBER TO BEGIN>'                              000180
                   REAO (9,10) I                                                          000190
10                10 FOPMAT(I1)                                                           000200
                   N=3                                                                    000210
                   GO TO 45                                                               000220
                  20 CALL EPS                                                             000230
                   PRINT *,' '                                                            000240
15                 PRINT *,' CURVE GENERATING POUTINE'                                    000250
                   PRINT *,' '                                                            000260
                   PRINT *,' OPTIONS:   0 = STOP'                                         000270
                   PRINT *,'            1 = PLOT'                                         000280
                   PRINT *,'            2 = CHANGE OATA'                                  000290
20                 PPINT *,' '                                                            000300
                   PRINT *,'   OPTION? >'                                                000310
                   READ *,IOPT                                                            000320
                   IF (IOPT.FQ.0) GO TO 99                                                000330
                   IF (IOPT.FQ.1) CALL WNOWBX(X,Y,1000,N,NPTS)                            000340
25                 IF (IOPT.FQ.2) GO TO 30                                                000350
                   IF (IOPT.LT.3.ANO.IOPT.GT.0) GO TO 20                                  000360
                   PRINT *,'  ERROR.... OPTION UNACCEPTABLE.. PLEASE RE-ENTEP>'          000370
                   GO TO 15                                                               000380
                  30 PRINT *,'   CUPVE 1 = C1 * SIN(X)'                                  000390
30                 PPINT *,'   CUPVE 2 = C2 * COS(X)'                                     000400
                   PPINT *,'   CUPVE 3 = C3 * ( C1 * SIN(X) + C2 * COS(X) )'             000410
                   PRINT *,' '                                                            000420
                   PRINT *,'  NUMBER OF CURVES TO PLOT? >'                               000430
35                 READ *,N                                                               000440
                   PPINT *,' '                                                            000450
                   PRINT *,'   MULTIPLIER(S)'                                           000460
                   DO 21 I=1,N                                                            000470
                   PRINT 40,S(I)                                                          000480
40                40 FORMAT(/'  COEFFICIENT FOR ',A9,' CURVE? >')                         000490
                   READ *,P                                                               000500
                   C1(I)=P                                                                000510
                  21 CONTINUE                                                             000520
                  45 00 22 I=1,300                                                        000530
45                 XX=FLOAT(I-1)*.02                                                      000540
                   X(I)=XX                                                                000550
                   X(300+I)=XX                                                            000560
                   X(600+I)=XX                                                            000570
                   Y(I)=C1(I)*SIN(XX)                                                     000580
50                 Y(300+I)=C1(2)*COS(XX)                                                 000590
                   Y(600+I)=C1(3)*(Y(I)+Y(300+I))                                         000600
                  22 CONTINUE                                                             000610
                   GO TO 20                                                               000620
                  99 STOP                                                                 000630
55                 ENO                                                                    000640
```

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